

A RADIO CONTROLLED BOX FOR THE REMOTE RELEASE OF INSECTS

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ABSTRACT. A description is given of a radio controlled box for the remote release of insects. It consists of a plaster-lined plastic container fitted with a battery and radio receiver which control a servo to open and close the lid. Instructions for construction and use are given.

In current studies on killing sand flies (*Phlebotomus ariasi* Tonnoir and *P. perniciosus* Newstead) by putting pyrethroid impregnated collars on dogs, we cage the dogs and expose them to known numbers of sand flies in large mosquito nets ($2.0 \times 1.8 \times 1.5$ m). This requires releasing hungry flies inside the nets in the absence of odor of man which could affect the behavior of the flies. We therefore devised a box which can be opened and closed by remote radio-control using equipment designed for model aircraft. A description of the box, which could be used remotely to release any flying insect, is given here. Depending upon the number and species of insects to be released, boxes of any appropriate size can be made using the same equipment.

The boxes are commercially available kitchen containers made of clear, rigid plastic (Figs. 1 and 2). Of several sizes available, we chose boxes of rectangular cross-section (13×9 cm) and a height of 11.5 cm. We first observed the survival of sand flies in a box to ensure the plastic was not toxic for them. Small projections to ensure a tight fit on the edge of the plastic lid were then filed off and the lid was hinged along one long side with industrial-grade cello tape. Two holes were made in the top. One (1 cm diam) was to put the sand flies in the box with a pooter. The other (2 cm diam), used to give the flies sucrose solution (50:50 vol/vol), was covered on the inside with fine stainless steel gauze fixed with a soldering iron. One prototype differed in that the center rectangle was cut out of the lid and replaced with glass fixed with superglue. This modification may be of use if it is necessary to give insects unobstructed light.

The bottom of the box was cut out and the base was filled to a depth of 2 cm with plaster of Paris. This was done with the box on plate glass so that the bottom had a smooth surface. Later, a thin layer of plaster was run around the sides to give a rough resting surface easily humidified by standing the box on damp filter paper.

The radio control equipment is System N7C-3SF of the JR PROPO "APEX 7" SERIES made by Japan Remote Control Co. Ltd and marketed

in the UK by J. R. Macgregor Co. Ltd., Langley Trading Estate, Slough, Bucks. It is comprised of a seven-channel transmitter (N127F), a receiver (MJR527), a nickel cadmium battery (JRB500), three standard servos (NES-505), a battery charger (NEC-121) and a switch harness. Each box requires a receiver, a battery, a servo and a switch harness, all of which can be bought separately to complement the system.

The servo is a 16 mm ferrite motor which runs off the battery and is operated by a signal from the transmitter picked up by the receiver. It has a torque of 47.75 oz/in and rotates 90° in 5 seconds. It is bolted to the side of the box before the sides are plastered and provides the power to open the lid. A piece of stiff copper wire (W1) (11 cm) is fixed by one end to the disc (D) of the servo with bolts. It is bent in the middle to an angle of 130° and the other end is wrapped round another piece of copper wire (W2) (4 cm) fixed to a short edge of the lid by bending the ends at right angles and pushing them into holes drilled in the edge (Fig. 1). When it is necessary to open the box manually, the bent piece of wire (W1) is disconnected from the short piece (W2) to avoid forcing the servo and, perhaps, damaging its gears.

The number of boxes which can be independently controlled depends on the number of functions available on the transmitter. On our equipment, there are 3 functions (landing gear and auxiliary equipment 1 and 2) controlled by individual switches, and 4 (throttle, rudder, elevator and aileron) controlled by 2 gimbals. Of these 4 the last 3 are of use only when the time the box is open is short; the reason is that the gimbal has to be held in position throughout the time of these operations.

If a series of boxes is to be opened at the same time, all are used with the same function. Theoretically, there is no limit to the number of boxes which can be opened by one function of a single transmitter, providing they are all within range.

The servos are plugged into the auxiliary 1 channels of the radio receivers, each of which is powered by a nickel-cadmium battery. When a

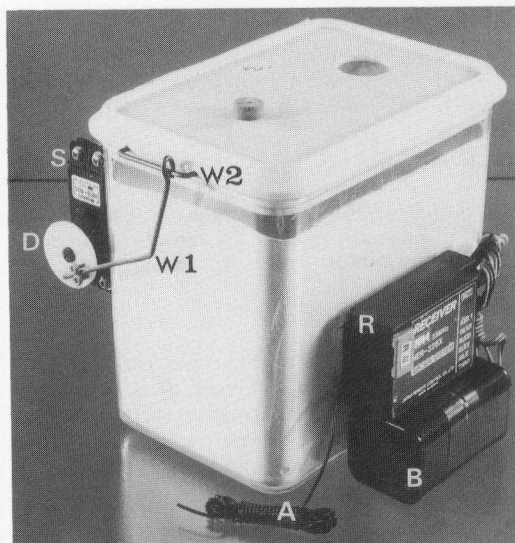


Fig. 1. Radio-controlled box with lid shut. R = radio receiver; B = battery; S = servo; D = disc of servo; A = aerial; W1 and W2 = wires linking servo and lid.

box is in use, the receiver, the battery and a switch harness are held on the side of the box with Velcro tape. They are removed when the battery is being charged, or when the boxes are being manipulated or transported to and from the field.

Without the antenna on the transmitter, the boxes can be operated at a distance of at least 15 m. However, the distance with the antenna in use is more than 500 m providing that there are no obstructions such as trees or hillocks along the line of sight. When sending a signal, the antenna should not be pointed directly at a receiver because the radiation pattern from the tip is inherently low.

The radio frequency can be altered by changing a module on the transmitter and a matching plug-in crystal on each receiver. The regulations governing the use of radio transmitters and per-

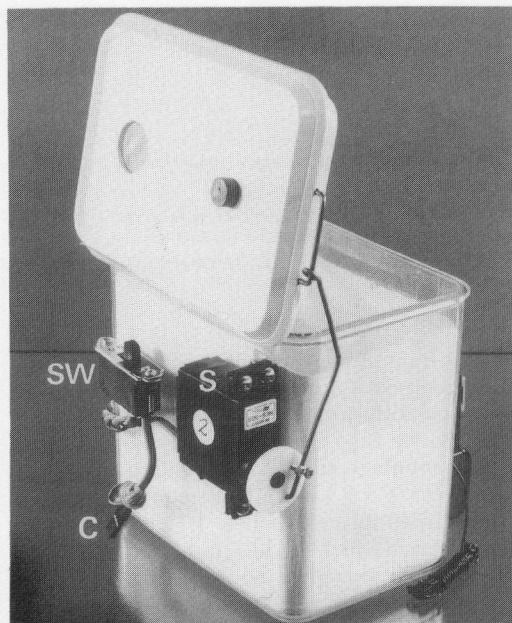


Fig. 2. Radio-controlled box with lid open. S = servo; SW = switch; C = connection for charging battery.

missible frequencies vary from country to country and a license may be required.

The advantages of using the boxes rather than emptying flies from pooters directly into the dog-baited mosquito net are: first, remote release avoids the presence of the operator influencing the behavior of the sand flies; second, flies can be released simultaneously from several boxes; and third, flies not responding to the presence of the dog in the mosquito net stay in the box and can later be subtracted from the total number put in the box.

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